SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

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CONTENTS:

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

ADDRESS OF THE PRESIDENT OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

II.

HOW TO GET MORE UNIVERSITIES.

What, then, is to be done? Fortunately, we have a precedent admirably in point, the consideration of which may help us to answer this question.

I have pointed out that in old days our Navy was chiefly provided by local and private effort. Fortunately for us, those days have passed away; but some twenty years ago, in spite of a large expenditure, it began to be felt by those who knew that in consequence of the increase of foreign navies, our sea-power was threatened, as now, in consequence of the increase of foreign universities, our brain-power is threatened.

The nation slowly woke up to find that its enormous commerce was no longer insured at sea, that in relation to foreign navies our own had been suffered to dwindle to such an extent that it was no longer capable of doing the duty which the nation expected of it even in time of peace. At first, this revelation was received with a shrug of incredulity, and the peace-at-any-price party denied that anything was needed; but a great teacher arose; * as the

* Captain Mahan, of the U. S. Navy, whose book, 'On the Influence of Sea-power on History,' has suggested the title of my address.

facts were inquired into the suspicion changed into an alarm; men of all parties saw that something must be done. Later, the nation was thoroughly aroused, and with universal agreement the principle was laid down that, cost what it might to enforce our sea-power, our Navy must be made and maintained of a strength greater than those of any two possibly contending powers. After establishing this principle, the next thing to do was to give effect to it. What did the nation do after full discussion and inquiry? A bill was brought in in 1888, and a sum of 21,500,000*l.* was voted in order, during the next five years, to inaugurate a large ship-building program, so that Britain and Britain's commerce might be guarded on the high seas in any event.

Since then we have spent 120,000,000*l.* on new ships, and this year we spend still more millions on still more new ships. If these prove insufficient to safeguard our sea-power, there is no doubt that the nation will increase them, and I have not heard that anybody has suggested an appeal to private effort.

How, then, do we stand with regard to universities, recognizing them as the chief producers of brain-power and therefore the equivalents of battleships in relation to sea-power? Do their numbers come up to the standard established by the Admiralty principle to which I have referred? Let us attempt to get a rough-and-ready estimate of our educational position by counting universities as the Admiralty counts battleships. I say rough and ready because we have other helps to greater brain-power to consider besides universities, as the Admiralty has other ships to consider besides ironclads.

In the first place, let us inquire if they are equal in number to those of any two nations commercially competing with us.

In the United Kingdom, we had until quite recently thirteen.† Of these, one is only three years old as a teaching university and another is still merely an examining board.

In Germany there are twenty-two universities; in France, under recent legislation, fifteen; in Italy twenty-one. It is difficult to give the number in the United States, because it is clear, from the tables given in the Report of the Commissioner of Education, that some colleges are more important than some universities, and both give the degree of Ph.D. But of universities in title we have 134. Among these, there are forty-six with more than fifty professors and instructors, and thirteen with more than 150. I will take that figure.

Suppose we consider the United States and Germany our chief commercial competitors, and apply the Admiralty principle. We should require, allowing for population, eight additional universities at the very lowest estimate.

We see, then, that instead of having universities equalling in number those of two of our chief competitors together, they are by no means equal to those of either of them singly.

After this statement of the facts, anyone who has belief in the importance of higher education will have no difficulty in understanding the origin of the present condition of British industry and its constant decline, first in one direction and then in another, since the tremendous efforts made in the United States and Germany began to take effect.

If, indeed, there be anything wrong about the comparison, the error can only arise from one of two sources; either the

† These are Oxford, Cambridge, Durham, Victoria, Wales, Birmingham, London, St. Andrews, Glasgow, Aberdeen, Edinburgh, Dublin and Royal University.

Admiralty is thoughtlessly and wastefully spending money, or there is no connection whatever between the higher intelligence and the prosperity of a nation. I have already referred to the views of Mr. Chamberlain and Lord Rosebery on this point; we know what Mr. Chamberlain has done at Birmingham; we know the strenuous efforts made by the commercial leaders of Manchester and Liverpool; we know, also, the opinion of men of science.

If while we spend so freely to maintain our sea-power our export of manufactured articles is relatively reduced because our competitors beat us in the markets of the world, what is the end of the vista thus opened up to us? A Navy growing stronger every year and requiring larger votes to guard our commerce and communications, and a vanishing quantity of commerce to guard—a reduced national income to meet an increasing taxation!

The pity is that our government has considered sea-power alone; that while so completely guarding our commerce, it has given no thought to one of the main conditions on which its production and increase depend: a glance could have shown that other countries were building universities even faster than they were building battleships; were, in fact, considering brain-power first and sea-power afterwards.

Surely it is my duty as your President to point out the danger ahead if such ignoring of the true situation should be allowed to continue. May I express a hope that at last, in Mr. Chamberlain's words, 'the time is coming when Governments will give more attention to this matter'?

WHAT WILL THEY COST?

The comparison shows that we want eight new universities, some of which, of course, will be colleges promoted to university rank and fitted to carry on university work. Three of them are already named: Manchester, Liverpool, Leeds.

Let us take this number and deal with it on the battleship condition, although a modern university on American or German models will cost more to build than a battleship.

If our present university shortage be dealt with on battleship conditions, to correct it we should expend *at least* 8,000,000*l.* for new construction, and for the pay-sheet we should have to provide ($8 \times 50,000l.$) 400,000*l.* yearly for personnel and up-keep, for it is of no use to build either ships or universities without manning them. Let us say, roughly, capitalizing the yearly payment at $2\frac{1}{2}$ per cent., 24,000,000*l.*

At this stage, it is important to inquire whether this sum, arrived at by analogy merely, has any relation to our real university needs.

I have spent a year in making inquiries, as full as I could make them, of friends conversant with the real present needs of each of the universities old and new; I have obtained statistics which would fill a volume, and personally I believe that this sum at least is required to bring our university system up to anything like the level which is insisted upon both in the United States and in Germany. Even Oxford, our oldest university, will still continue to be a mere bundle of colleges, unless three millions are provided to enable the university properly so-called to take her place among her sisters of the modern world; and Sir Oliver Lodge, the principal of our very youngest university, Birmingham, has shown in detail how five millions can be usefully and properly applied in that one locality, to utilize for the good of the nation the enthusiasm and scientific capacity which are only waiting for adequate opportunity of development.

How is this money to be raised? I reply

without hesitation, *duplicate the Navy Bill of* 1888–9; do at once for brain-power what we so successfully did then for sea-power.

Let 24,000,000*l*. be set apart from one asset, our national wealth, to increase the other, brain-power. Let it be assigned and borrowed as it is wanted; there will be a capital sum for new buildings to be erected in the next five or ten years, the interest of the remainder to go towards increased annual endowments.

There need be no difficulty about allocating money to the various institutions. Let each university make up its mind as to which rank of the German universities it wishes to emulate. When this claim has been agreed to, the sums necessary to provide the buildings and teaching staff of that class of university should be granted without demur.

It is the case of battleships over again, and money need not be spent more freely in one case than in the other.

Let me at once say that this sum is not to be regarded as practically gone when spent, as in the case of a short-lived iron-clad. *It is a loan* which will bear a high rate of interest. This is not my opinion merely; it is the opinion of those concerned in great industrial enterprises and fully alive to the origin and effects of the present condition of things.

I have been careful to point out that the statement that our industries are suffering from our relative neglect of science does not rest on my authority. But if this be true, then if our annual production is less by only two millions than it might have been, having two millions less to divide would be equivalent to our having forty or fifty millions less capital than we should have had if we had been more scientific.

Sir John Brunner, in a speech connected with the Liverpool School of Tropical Medicine, stated recently that if we as a nation were now to borrow ten millions of money in order to help science by putting up buildings and endowing professors, we should get the money back in the course of a generation a hundredfold. He added that there was no better investment for a business man than the encouragement of science, and that every penny he possessed had come from the application of science to commerce.

According to Sir Robert Giffen, the United Kingdom as a going concern was in 1901 worth 16,000,000,000*l*.

Were we to put aside 24,000,000*l*. for gradually organizing, building and endowing new universities, and making the existing ones more efficient, we should still be worth 15,976,000,000*l*., a property well worth defending by all the means, and chief among these brain-power, we can command. If it be held that this, or anything like it, is too great a price to pay for correcting past carelessness or stupidity, the reply is that the 120,000,000*l*. recently spent on the navy, a sum five times greater, has been spent to correct a sleepy blunder, not one whit more inimical to the future welfare of our country than that which has brought about our present educational position. We had not sufficiently recognized what other nations had done in the way of ship building, just as until now we have not recognized what they have been doing in university building.

Further, I am told that the sum of 24,000,000*l*. is less than half the amount by which Germany is yearly enriched by having improved upon our chemical industries, owing to our lack of scientific training. Many other industries have been attacked in the same way since, but taking this one instance alone, if we had spent this money fifty years ago, when the Prince Consort first called attention to our backwardness,

the nation would now be much richer than it is, and would have much less to fear from competition.

Suppose we were to set about putting our educational house in order, so as to secure a higher quality and greater quantity of brain-power, it would not be the first time in history that this has been done. Both Prussia after Jena and France after Sedan acted on the view:

> "When land is gone and money spent,
> Then learning is most excellent."

After Jena, which left Prussia a 'bleeding and lacerated mass,' the King and his wise counsellors, among them men who had gained knowledge from Kant, determined, as they put it, 'to supply the loss of territory by intellectual effort.'

What did they do? In spite of universal poverty, three universities, to say nothing of observatories and other institutions, were at once founded, secondary education was developed, and in a few years the mental resources were so well looked after that Lord Palmerston defined the kingdom in question as 'a country of damned professors.'

After Sedan, a battle, as Moltke told us, 'won by the school-master,' France made even more strenuous efforts. The old University of France, with its 'academies' in various places, was replaced by fifteen independent universities, in all of which are faculties of letters, sciences, law and medicine.

The development of the University of Paris has been truly marvellous. In 1897–8, there were 12,000 students, and the cost was 200,000*l*. a year.

But even more wonderful than these examples is the 'intellectual effort' made by Japan, not after a war, but to prepare for one.

The question is, shall we wait for a disaster and then imitate Prussia and France? or shall we follow Japan, and thoroughly prepare by 'intellectual effort' for the industrial struggle which lies before us?

Such an effort seems to me to be the first thing any national or imperial scientific organization should endeavor to bring about.

RESEARCH.

When dealing with our universities, I referred to the importance of research, as it is now generally acknowledged to be the most powerful engine of education that we possess. But education after all is but a means to the end which, from the national point of view, is the application of old and the production of new knowledge.

Its national importance apart from education is now so generally recognized that in all civilized nations except our own means of research are being daily more amply provided for all students after they have passed through their university career, and more than this, for all who can increase the country's renown or prosperity by the making of new knowledge upon which not only commercial progress, but all intellectual advance must depend.

I am so anxious that my statement of our pressing, and indeed imperative, needs in this direction should not be considered as resting upon the possibly interested opinion of a student of science merely, that I must trouble you with still more quotations.

Listen to Mr. Balfour:—

"I do not believe that any man who looks round the equipment of our universities or medical schools, or other places of education, can honestly say in his heart that we have done enough to equip research with all the costly armory which research must have in these modern days. We, the richest country in the world, lag behind Germany, France, Switzerland and Italy.

Is it not disgraceful? Are we too poor or are we too stupid?"*

It is imagined by many who have given no thought to the matter that this research should be closely allied with some application of science being utilized at the time. Nothing could be further from the truth; nothing could be more unwise than such a limitation.

Surely all the laws of nature will be ultimately of service, and, therefore, there is much more future help to be got from a study of the unknown and the unused than we can hope to obtain by continuing the study of that which is pretty well known and utilized already. It was a King of France, Louis XIV., who first commended the study of the *même inutile*. The history of modern science shows us more and more as the years roll on the necessity and advantage of such studies, and, therefore, the importance of properly endowing them, for the production of new knowledge is a costly and unremunerative pursuit.

Years ago we had Faraday apparently wasting his energies and time in playing with needles; electricity now fills the world. To-day men of science in all lands are studying the emanations of radium; no research could be more abstract; but who knows what advance in human thought may follow or what gigantic world-transforming superstructure may eventually be raised on the minute foundation they are laying?

If we so organize our teaching forces that we can use them at all stages from the gutter to the university to sift out for us potential Faradays—to utilize the mental products which otherwise would be wasted—it is only by enabling such men to continue their learning after their teaching is over that we shall be able to secure the greatest advantage which any educational system can afford.

It is now more than thirty years ago that my attention was specially drawn to this question of the endowment of research, first by conversations with M. Dumas, the permanent secretary of the Academy of Sciences, who honored me by his friendship, and secondly by my association with Sir Benjamin Brodie and Dr. Appleton in their endeavors to call attention to the matter in this country. At that time a general scheme of endowment suggested by Dumas was being carried out by Duruy. This took the form of the 'Ecole spéciale des Hautes Etudes'; it was what our fellowship system was meant to be—an endowment of the research of post-graduate students in each seat of learning. The French effort did not begin then.

I may here tell, as it was told me by Dumas, the story of Léon Foucault, whose many discoveries shed a glory on France, and revived French industry in many directions.* In 1851, when Prince Napoleon was President of the Republic, he sent for Dumas and some of his colleagues and told them that during his stay in England, and afterwards in his study of the Great Exhibition of that year, he had found there a greater industrial development than in France, and more applications of science, adding that he wished to know how such a state of things could be at once remedied. The answer was that new applications depended upon new knowledge, and that, therefore, the most direct and immediate way was to find and encourage men who were likely by research in pure science to produce this new knowledge. The Prince President at once asked for names; that of Léon Foucault was the only one mentioned during the first interview.

* *Nature*, May 30, 1901.

* See *Proc. R. S.*, Vol. XVII., p. lxxxiii.

Some time afterwards, to be exact at about 11 in the morning of December 2, Dumas's servant informed him that there was a gentleman in the hall named Foucault who wished to see him, and he added that he appeared to be very ill. When shown into the study, Foucault was too agitated to speak, and was blind with tears. His reply to Dumas's soothing questions was to take from his pockets two rolls of bank notes amounting to 200,000 francs and place them on the table. Finally, he was able to say that he had been with the Prince President since 8 o'clock that morning discussing the possible improvement of French science and industry, and that Napoleon had finally given him the money requesting him to do all in his power to aid the State. Foucault ended by saying that on realizing the greatness of the task thus imposed upon him, his fears and feelings had got the better of him, for the responsibility seemed more than he could bear.*

The movement in England to which I have referred began in 1872, when a society for the organization of academical study was formed in connection with the inquiry into the revenues of Oxford and Cambridge, and there was a famous meeting at the Freemasons' Tavern, Mark Pattison being in the chair. Brodie, Rolleston, Carpenter, Burdon-Sanderson were among the speakers, and the first resolution carried was, 'That to have a class of men whose lives are devoted to research is a national object.' The movement died in consequence of the want of sympathy of the university authorities.*

In the year 1874 the subject was inquired into by the late Duke of Devonshire's Commission, and after taking much remarkable evidence, including that of Lord Salisbury, the Commission recommended to the Government that the then grant of 1,000*l.* which was expended, by a committee appointed by the Royal Society, on instruments needed in researches carried on by private individuals should be increased, so that personal grants should be made. This recommendation was accepted and acted on; the grant was increased to 4,000*l.*, and finally other societies were associated with the Royal Society in its administration. The committee, however, was timorous, possibly owing to the apathy of the universities and the general carelessness on such matters, and only one personal grant was made; the whole conception fell through.

Meantime, however, opinion has become more educated and alive to the extreme importance of research to the nation, and in 1891 a suggestion was made to the Royal Commission which administers the proceeds of the 1851 Exhibition that a sum of about 6,000*l.* a year available for scholarships should be employed in encouraging post-graduate research throughout the whole empire. As what happened is told in the 'Memoirs of Lord Playfair,' it is not indiscreet in me to state that when I proposed this new form of the endowment of research, it would not have surprised me if the suggestion had been declined. It was carried through by Lord Playfair's enthusiastic support. This system has been at work ever since, and the good that has been done by it is now generally conceded.

It is a supreme satisfaction to me to

* In order to show how history is written, what actually happened on a fateful morning may be compared with the account given by Kinglake:—"Prince Louis rode home and went in out of sight. Then for the most part he remained close shut up in the Elysée. There, in an inner room, still decked in red trousers, but with his back to the daylight, they say he sat bent over a fireplace for hours and hours together, resting his elbows on his knees, and burying his face in his hands" ('Crimean War,' I., p. 245).

* See *Nature*, November and December, 1872.

know that in this present year of grace the national importance of the study of the *même inutile* is more generally recognized than it was during the times to which I have referred in my brief survey, and, indeed, we students are fortunate in having on our side in this matter two members of His Majesty's Government, who two years ago spoke with no uncertain sound upon this matter.

"Do we lack the imagination required to show what these apparently remote and abstract studies do for the happiness of mankind? We can appreciate that which obviously and directly ministers to human advancement and felicity, but seem, somehow or another, to be deficient in that higher form of imagination, in that longer sight, which sees in studies which have no obvious, necessary or immediate result the foundation of the knowledge which shall give far greater happiness to mankind than any immediate, material, industrial advancement can possibly do; and I fear, and greatly fear, that, lacking that imagination, we have allowed ourselves to lag in the glorious race run now by civilized countries in pursuit of knowledge, and we have permitted ourselves so far to too large an extent to depend upon others for those additions to our knowledge which surely we might have made for ourselves." —Mr. Balfour, *Nature*, May 30, 1901.

"I would remind you that all history shows that progress—national progress of every kind—depends upon certain individuals rather than upon the mass. Whether you take religion, or literature, or political government, or art, or commerce, the new ideas, the great steps, have been made by individuals of superior quality and genius who have, as it were, dragged the mass of the nation up one step to a higher level. So it must be in regard to material progress. The position of the nation to-day is due to the efforts of men like Watt and Arkwright, or, in our own time, to the Armstrongs, the Whitworths, the Kelvins and the Siemenses. These are the men who, by their discoveries, by their remarkable genius, have produced the ideas upon which others have acted and which have permeated the whole mass of the nation and affected the whole of its proceedings. Therefore, what we have to do, and this is our special task and object, is to produce more of these great men."—Mr. Chamberlain, *Times*, January 18, 1901.

I finally come to the political importance of research. A country's research is as important in the long run as its battleships. The most eloquent teaching as to its national value we owe to Mr. Carnegie, for he has given the sum of 2,000,000*l.* to found a system of endowments, his chief purpose being, in his own words, 'to secure if possible for the United States of America leadership in the domain of discovery and the utilization of new forces for the benefit of man.'

Here is a distinct challenge to Britain. Judging by experience in this country, in spite of the magnificent endowment of research by Mond and Lord Iveagh, the only sources of possible competition in the British interest is the State, which certainly could not put the 1/8000 part of the accumulated wealth of the country to better use, for without such help both our universities and our battleships will become of rapidly dwindling importance.

It is on this ground that I have included the importance of endowing research among the chief points to which I have been anxious to draw your attention.

THE NEED OF A SCIENTIFIC NATIONAL COUNCIL.

In referring to the new struggle for existence among civilized communities, I pointed out that the solution of a large

number of scientific problems is now daily required for the State service, and that in this and other ways the source and standard of national efficiency have been greatly changed.

Much evidence bearing upon the amount of scientific knowledge required for the proper administration of the public departments and the amount of scientific work done by and for the nation was brought before the Royal Commission on Science presided over by the late Duke of Devonshire now more than a quarter of a century ago.

The Commission unanimously recommended that the State should be aided by a scientific council in facing the new problems constantly arising.

But while the home Government has apparently made up its mind to neglect the advice so seriously given, it should be a source of gratification to us all to know that the application of the resources of modern science to the economic, industrial and agricultural development of India has for many years engaged the earnest attention of the Government of that country. The Famine Commissioners of 1878 laid much stress on the institution of scientific inquiry and experiment designed to lead to the gradual increase of the food-supply and to the great stability of agricultural outturn, while the experience of recent years has indicated the increasing importance of the study of the economic products and mineral-bearing tracts.

Lord Curzon has recently ordered the heads of the various scientific departments to form a board, which shall meet twice annually, to begin with, to formulate a program and to review past work. The board is also to act as an advisory committee to the Government,* providing among other matters for the proper coordination of all matters of scientific inquiry affecting India's welfare.

* *Nature*, September 4, 1902.

Lord Curzon is to be warmly congratulated upon the step he has taken, which is certain to bring benefit to our great dependency.

The importance of such a board is many times greater at home, with so many external as well as internal interests to look after, problems common to peace and war, problems requiring the help of the economic as well as of the physical sciences.

It may be asked, What is done in Germany, where science is fostered and utilized far more than here?

The answer is, there is such a council. I fancy very much like what our Privy Council once was. It consists of representatives of the Ministry, the universities, the industries and agriculture. It is small, consisting of about a dozen members, consultative, and it reports direct to the Emperor. It does for industrial war what military and so-called defence councils do for national armaments: it considers everything relating to the use of brain-power in peace, from alterations in school regulations and the organization of the universities, to railway rates and fiscal schemes, including the adjustment of duties. I am informed that what this council advises generally becomes law.

It should be pretty obvious that a nation so provided must have enormous chances in its favor. It is a question of drilled battalions against an undisciplined army, of the use of the scientific spirit as opposed to the hope of 'muddling through.'

Mr. Haldane has recently reminded us that 'the weapons which science places in the hands of those who engage in great rivalries of commerce leave those who are without them, however brave, as badly off as were the dervishes of Omdurman against the Maxims of Lord Kitchener.'

Without such a machinery as this, how can our Ministers and our rulers be kept completely informed on a thousand things of vital importance? Why should our position and requirements as an industrial and thinking nation receive less attention from the authorities than the headdress of the Guards? How, in the words of Lord Curzon,* can 'the life and vigor of a nation be summed up before the world in the person of its sovereign' if the national organization is so defective that it has no means of keeping the head of the State informed on things touching the most vital and lasting interests of the country? We seem to be still in the Palæolithic age in such matters, the chief difference being that the sword has replaced the flint implement.

Some may say that it is contrary to our habit to expect the Government to interest itself too much or to spend money on matters relating to peace; that war dangers are the only ones to be met or to be studied.

But this view leaves science and the progress of science out of the question. Every scientific advance is now, and will in the future be more and more, applied to war. It is no longer a question of an armed force with scientific corps, it is a question of an armed force scientific from top to bottom. Thank God the Navy has already found this out. Science will ultimately rule all the operations both of peace and war, and therefore the industrial and the fighting population must both have a large common ground of education. Already it is not looking too far ahead to see that in a perfect State there will be a double use of each citizen, a peace use and a war use, and the more science advances the more the old difference between the peaceful citizen and the man at arms will disappear; the barrack, if it still exists, and the workshop will be assimilated, the land unit, like the battleship, will become a school of applied science, self-contained, in which the officers will be the efficient teachers.

* *Times*, September 30, 1902.

I do not think it is yet recognized how much the problem of national defence has thus become associated with that with which we are now chiefly concerned.

These, then, are some of the reasons which compel me to point out that a scientific council, which might be a scientific committee of the Privy Council, in dealing primarily with the national needs in times of peace, would be a source of strength to the nation.

To sum up, then. My earnest appeal to you is to gird up your loins and see to it that the science of the British Empire shall no longer remain unorganized. I have endeavored to point out to you how the nation at present suffers from the absence of a powerful, continuous, reasoned expression of scientific opinion, urging in season and out of season that we shall be armed as other nations are with efficient universities and facilities for research to uphold the flag of Britain in the domain of learning and discovery, and what they alone can bring.

I have also endeavored to show how, when this is done, the nation will still be less strong than it need be if there be not added to our many existing councils another, to secure that, even during peace, the benefits which a proper coordination of scientific effort in the nation's interest can bring shall not be neglected as they are at present.

Lest some of you may think that the scientific organization which I trust you will determine to found would risk success in working on such large lines, let me remind you that in 1859, when the late Prince Consort occupied this chair, he referred to 'impediments' in scientific prog-

ress, and said: "they are often such as can only be successfully dealt with by the powerful arm of the State or the long purse of the nation."

If the Prince Consort had lived to continue his advocacy of science, our position to-day would have been very different. His early death was as bad for Britain as the loss of a great campaign. If we can not regain what we have lost, matters can not mend.

I have done what I feel to be my duty in bringing the present condition of things before you. It is now your duty, if you agree with me, to see that it be put right. You can if you will.

Norman Lockyer.

THE EXPEDITION TO THE BAHAMA ISLANDS OF THE GEOGRAPHICAL SOCIETY OF BALTIMORE.

In October, 1902, a number of citizens of Baltimore met at the residence of Dr. Daniel C. Gilman and organized the Geographical Society of Baltimore. The officers elected at that time were:

President—Daniel C. Gilman.
Vice-Presidents—Bernard N. Baker, Rev. John F. Goucher and Lawrason Riggs.
Treasurer—Robert Garrett.
Secretary—George B. Shattuck.

The purpose of organizing this society was the accumulation and distribution of geographic knowledge. The society rapidly increased in numbers, and within a few weeks included about 1,750 members, most of them citizens of Baltimore. A course of six lectures was given before the society in one of the large auditoriums of Baltimore. Early in the winter steps were taken to equip an expedition which should visit the Bahama Islands for the sake of prosecuting scientific work in that region. Several thousand dollars were quickly raised from various sources and the writer was asked to act as director of this expedition.

A large two-masted sailing vessel was chartered, provisioned and equipped for the work in hand and left Baltimore on the evening of June 1. The expedition was gone two months, arriving in Baltimore on the morning of July 30. With the exception of the inevitable seasickness, which many of the party experienced on the way out, the health of the entire company was excellent, not a single case of sickness arising.

The governor and residents of the Bahama Islands were advised of the purpose of the expedition many weeks before it left Baltimore and cooperated in every way possible to make the work successful.

The Johns Hopkins University in Baltimore, the National Museum, the United States Coast and Geodetic Survey, Agricultural Department, United States Weather Bureau and the Fish Commission of Washington and the University of Iowa also cooperated by either men, equipment or advice toward the success of the expedition.

The tide gauge now in operation at Nassau and the magnetic instruments used throughout the cruise were kindly loaned by the United States Coast and Geodetic Survey. Deep-sea thermometers, seines and other paraphernalia for marine work were loaned by the Fish Commission. The kites for high atmospheric work were loaned by the United States Weather Bureau.

The men who composed the scientific staff and took part in the investigations are as follows:

Dr. George B. Shattuck, director and chief of geological staff.

Dr. B. L. Miller, associate professor in Bryn Mawr College, associate geologist.

Dr. Clement A. Penrose, vice-director and surgeon of the expedition, chief of the medical staff.

Messrs. H. P. Cole, E. B. Beasley and T. H. Coffin, of the Johns Hopkins Medical School, assistants to Dr. Penrose.

Dr. W. C. Coker, of the University of North Carolina, chief of the botanical staff.

Messrs. C. A. Shore and F. M. Haynes, of the University of North Carolina, botanical assistants.

Mr. Barton A. Bean, curator of fishes in the United States National Museum, chief of staff of marine zoology.

Messrs. J. B. Custis and J. A. Lewis, of Johns Hopkins, assistants in marine zoology.

Mr. J. H. Riley, curator in the United States Museum, chief of staff for land zoology.

Mr. S. H. Derickson, assistant in land zoology.

Dr. Oliver L. Fassig, section director of the United States Weather Bureau, chief of staff of climatology and physics.

Mr. J. E. Ruth, Johns Hopkins University, assistant in climatology and physics.

Mr. C. N. Mooney, United States Department of Agriculture, chief of the soil survey.

Messrs. J. C. Britton and E. C. Hughes, United States Department of Agriculture, assistants in soil survey.

Mr. J. M. Wright, Johns Hopkins, historian.

Mr. A. H. Baldwin, of Washington, artist.

Mr. Frank Gilmore, foreign correspondent.

The results of the expedition may be briefly summarized as follows:

GEOLOGICAL SURVEY.

Work of Previous Investigators.—Many geologists have visited the Bahama Islands in times past, have studied the geological formations with more or less care and have arrived at the following conclusions:

1. The material of which the Bahama Islands are built is wind-blown coral sand.

2. The islands were formerly very much more extensive than now.

3. They are gradually being depressed beneath the surface of the Atlantic Ocean.

4. They are gradually being eroded by the waves.

5. They are slowly being elevated.

It will be noticed that there are two opposing views here, namely, that the islands are undergoing subsidence, and second, that they are being elevated.

Conclusions Arising from the Present Survey.—The geology of the Bahama Islands is not difficult or extremely varied. It presents a number of most interesting problems and exhibits a number of most instructive types of topography. The present survey has been able to determine that the material composing the Bahama Islands is not entirely made up of wind-blown coral and lime sand, but the lower portions of many of the islands, extending up to ten or fifteen or twenty-five feet above the present level of mean tide, has been deposited by the ocean and contains marine organisms in large numbers. Above this lies the deposit of wind-blown material which has up to this time been regarded as the sole type of deposit visible throughout the archipelago.

In regard to the question of elevation or subsidence, the survey has determined that both processes have taken place. The islands were doubtless much higher at one time than to-day, and it is equally certain that they were formerly more depressed beneath the Atlantic Ocean than they are now. It is impossible to say whether they are being elevated or submerged at the present time, as the process is extremely slow at best, and can only be detected by careful measurement extending over long periods of time. It is for this reason and to settle this question that a bench mark and tide gauge have been erected at Nassau.

BOTANICAL SURVEY.

Previous Investigations on Plants.—A number of botanists have made more or less extensive investigations on the plants in the Bahama Islands, but as a rule their studies have tended toward purely systematic classification of the flowering plants and published lists of the same with their localities throughout the archipelago..

Present Botanical Survey.—The work of the present survey has been:

1. To supplement the systematic work of earlier investigators by visiting islands

heretofore unstudied and by collecting some five hundred or more plants for future study and report.

2. The collection and study of lower forms of plant life, such as seaweed, fresh- and salt-water algæ, fungi, lichens and myxomycetes. The work on this latter group is new, as none have heretofore been reported from the Bahama Islands and the present survey has secured about twenty or thirty species.

3. The principal work of the botanical survey, however, has been, not so much the systematic study of forms, as the study of plants in their adaptation to their environments, the grouping of plants in societies and on certain formations and soil types and the variation of the same plants under different conditions to special changes in environment. A large number of photographs of typical plants were also secured.

SURVEY OF MARINE LIFE.

Survey of Marine Fauna.—Much work has been done on the marine life of the Bahamas and many valuable results secured.

Present Survey.—The aims of the present survey have been:

1. To secure color sketches of a number of the most interesting and important fishes of the Bahama Islands which have not been figured from other waters.

2. To secure specimens of fishes for the United States National Museum.

3. The study of the distribution of the Bahama fishes in reference to other fishes of the West Indian waters.

4. In prosecuting this work the marine survey has secured a thousand or more specimens of marine life.

5. The artist has made about twenty-five color sketches of the fishes of the Bahama waters, certain of which will be published in color in the proposed report.

SURVEY OF LAND FAUNA.

Work of Previous Collectors.—The Bahama Islands have been exhaustively studied by zoologists in previous years and large collections of birds have been made from time to time. Notwithstanding these investigations, problems have constantly come to light which have required further study, and in order to prosecute this work short expeditions have been made to the Bahama Islands for special purposes, such as the study of the habits of certain birds and the collection of certain types of life.

Present Survey.—The objects of the present survey have been:

1. To augment the collection of the United States National Museum along certain lines in the types of reptiles, birds and mammals.

2. To note the habits of certain birds as occasion offered.

3. To collect especially bats for future study in the United States National Museum.

4. To secure as representative a collection as possible for display in one of the institutions of Baltimore city.

5. In prosecuting this work about two hundred and sixty skins of representative birds, a hundred specimens of reptiles and about three hundred mammals have been secured.

ATMOSPHERIC SURVEY.

Work of Previous Investigators.—Previous investigations have consisted of a comprehensive and excellent collection of daily weather observations which have been published from time to time and have afforded the basis of the present work.

Work of the Present Survey.—1. The discussion of previous observations.

2. The securing of a continuous record of climatic conditions by means of self-recording instruments in regard to pressure, temperature and humidity from the

date of the arrival of the expedition at Nassau to the time of its departure.

3. The flying of kites in order to make observations of meteorological conditions in the upper atmosphere. Six ascents have been made ranging in altitude from four thousand to eight thousand feet and excellent records have been secured in each one of these ascents. This work has never before been attempted in these latitudes. A most interesting feature of these kite investigations was the successful flight of a kite from the deck of a steam launch to the elevation of eight thousand feet in the open sea.

Survey of the Tide and Erection of Bench Mark.—This work is entirely new for the Bahama Islands, and as stated above has for its aim the solution of the problem whether the islands are being elevated or submerged. The bench mark erected at Nassau, as far as I know, is the first to be established throughout the West Indian region. The tide gauge which has been established is a self-recording instrument that will run for one year, and its records will afterwards be reduced and the computation of mean tide level for Nassau harbor will be determined by the United States Coast and Geodetic Survey.

MAGNETIC SURVEY.

Work of Previous Investigators.—In the past hundred years from twenty-five to thirty observations have been made at ten or twelve stations throughout the archipelago. These observations have been almost entirely confined to the observation of magnetic declination.

The Work of the Present Survey.—The work of the present survey has been:

To determine the declination, dip and intensity of the terrestrial magnetism at a number of points in the Bahama Islands, especially at points previously occupied. Full sets of observations have been made at Nassau, Watling's, Clarence Town and Abaco. These observations will be reduced by the United States Coast and Geodetic Survey.

MEDICAL SURVEY.

The medical staff has stopped at and examined from a medical and sanitary standpoint the following settlements on the different islands of the Bahamas: New Providence, including Nassau and the surrounding country, with especial attention to the hospitals, etc., several of the largest schools and a number of private cases shown through the courtesy of the resident physicians. The water supply from a number of wells in the hospital grounds, Nassau, Grants Town and other parts of the island have been examined chemically and microscopically.

At those settlements or islands where there were no resident physicians the medical and surgical equipment was carried on shore and free dispensaries opened up. In some cases where the ship was able to anchor close to the shore, free clinics were held on her decks or in the main cabin, especially whenever it was necessary to operate on any of the conditions met with. In the settlements where the resident physicians were found they were in all instances sought out and questioned concerning the nature of their practice, diseases found, their treatment, condition of the people, etc. The homes of the natives were studied from a sanitary standpoint, a number of their dwelling places entered and inspected and physical and blood examinations made.

In a brief summary it would be impossible to go into the special studies to be included in a future report on these islands, but in general we were much impressed with the following:

1. The prevalence of leprosy. This disease included the three types, anæsthetic,

mixed and tubercular. Little care is taken in the isolation of these cases, as they mix freely with their fellows in the ordinary routine of life. In one or two instances pilots who desired to take our ship into harbors were found to have leprosy in more or less advanced stages.

2. The much better physical types presented by the pure blacks or whites in contrast with those of mixed blood. This was true especially of the pure blacks, probably from the reason that they have intermarried less than pure whites. Arranging the natives in order from the standpoint of their immunity to disease, we would place the pure blacks first, the pure whites second and mixed types last.

3. The direct relation of health to food. The islands where most farming was done presented a better type of people than those relying chiefly on fishing and sea industry for support.

4. The great prevalence of locomotor ataxia, rheumatism, neuralgia, ainhum or ring-toe, genito-urinary diseases, including syphilis, gonorrhœa, etc., eye diseases, including pinguicula, pterygium, ophthalmia, gonorrhœa, etc., interstitial keratitis, cataracts and errors in refraction, muscle balance, etc., dyspepsias and some diarrhœa due to poor food and exposure.

5. The presence of the filariæ sanguinis in the blood of one of the patients examined in the Nassau hospital. This case is said to have come from Long Island.

6. One case of elephantiasis in the leg of a woman living at Current Settlement, Eleuthera.

7. The type of malaria. It showed the malignant variety of parasites in the blood, but was of a mild type and not typical in its behavior. This alone would make an interesting scientific investigation.

8. Distribution of mosquitoes. The mosquitoes have been studied at all the different places visited with the result that several known varieties and unknown species, at least to our collector, have been found, and the places where obtained carefully noted. This collection has been purchased by Dr. L. O. Howard and will be worked up by him.

9. Most interesting studies were made of the inhabitants of Hope Town, Abaco, in order to determine the amount of degeneracy due to close intermarrying. At the close of the Revolutionary War this settlement was peopled by tories from America who desired to continue under British rule. For over a hundred years the inhabitants of Hope Town have intermarried so closely that now a man is related to his wife by more than one line of relationship. Charts constructed by Dr. Penrose established this point. The result has been that frightful degeneracy has taken place, resulting in many disorders and serious bodily deformations.

In all over a thousand people were seen professionally, and although many of these were not given medicines, nevertheless a number, possibly one half, received treatment, medical or surgical and advice regarding living, food, general hygiene. The cleanliness of the people as a whole and their good health in spite of poor food much impressed us, due unquestionably to the balmy climate of the Bahamas and the fact that the settlements are not yet overcrowded.

Special examinations for conditions interesting to the expedition were made in one hundred and fifteen cases and records kept of each one. Forty-three blood examinations were made, some of these at night. Owing to the short stops at the different settlements it was impossible to follow the effect of treatment in many of the cases that came to us for assistance.

SOIL SURVEY.

The soil survey was also in advance of anything previously attempted in the Bahamas. The men who conducted the soil investigations were experts in their particular subject and have succeeded in collecting a vast amount of information for future study and investigation. In all six of the more important islands of the archipelago were mapped in detail in such a manner as to show distribution of the principal soil types. These will be reproduced in color in the report. A large number of chemical analyses were made in a temporary laboratory erected in Nassau, in order to determine those properties of the soils which are apt to be lost if the samples are allowed to stand for any length of time. In addition to these preliminary investigations, more elaborate ones will be conducted later, in order to determine other properties of the soils essential to successful agriculture. It is too early at the present time to discuss the results of the soil survey at length, but I feel at liberty to say that when investigations are carried to their conclusion most valuable information will be at hand to direct the farmers of the Bahamas along intelligent lines of agriculture.

HISTORICAL INVESTIGATION.

The work of examining the public records and writing the history of the Bahama Islands has been going steadily forward all summer. The historian did not cruise among the out islands with the rest of the members of the expedition, but remained at work at Government House, Nassau, where the official records were kindly placed at his disposal by the governor. His paper, when completed, will treat of the development of the Bahama Islands as a crown colony of Great Britain.

COMMERCIAL GEOGRAPHY.

Material has been collected for a chapter on the commercial geography of the islands. This will discuss not only the products of the islands, but also the exports and imports, means of communication, condition of the people, etc.

These results and many others which can not be mentioned in this brief notice will be duly set forth in a report which is now being prepared.

GEO. B. SHATTUCK,
Director Bahama Expedition.

SCIENTIFIC BOOKS.

The Theory of Optics. By PAUL DRUDE. Translated from the German by C. R. MANN and R. A. MILLIKAN. New York, Longmans, Green & Co. 1902. Pp. xxi + 546.

During the past thirty years the science of optics has developed with surprising rapidity; in fact, in few of the branches of science have greater and more far-reaching changes in the fundamental concepts been made. This rapidity of growth may be attributed in large measure to the inspiration derived from the fertile hypothesis that was first suggested by Faraday and afterwards worked out in detail by Maxwell; for it was this hypothesis that called the attention of physicists to the possibility of unifying the sciences of optics and electricity under a single theory and of thus treating them both as manifestations of the phenomena of a common medium, the ether. The experimental work that was undertaken for the purpose of testing this Faraday-Maxwell hypothesis has led to extensions and modifications of the original supposition until it has now developed into an extensive and well-established theory, namely, the electromagnetic theory of light.

To the student of modern physics some comprehension of this fascinating theory is indispensable; yet such comprehension has been difficult to obtain because the various fragments of the argument by which the theory has been built up have been scattered in the

scientific journals and have hence been inaccessible to many who might otherwise desire to study them. Hence the gathering together into one volume of the main points of that argument, together with a discussion of how they have been used in the establishment of that theory and of the present tendencies and possibilities of that theory, is performing a great service not only to those who desire to learn of the theory, but also to the theory itself, since such work must help to show where modification and extension of the theory are possible and desirable.

It was a desire to meet these needs both of the student and of the theory that led Professor Drude to undertake the production of the work before us. Hence the purpose of the book is to supply a modern text embracing the entire subject of optics, and to make possible a deeper insight into the modern theory of light.

In order to attain this purpose, the author omits most of the older historical references, and gives only those later ones that will prove useful to the reader in finding the more extended discussions in the periodical literature. In fact, the greater part of the book treats of the work done during the last fifteen or twenty years. Hence it differs essentially from other treatises, many of which mention only the work done previous to the last fifteen or twenty years. Thus the discussion of the various mechanical theories of light, with their perplexities as to a mechanically incompressible ether and their shrewd and subtile attempts to annihilate the longitudinal vibrations by assumptions that lead to worse complications, give place in this book to a presentation of the electromagnetic theory, to a tracing of that theory in its consequences, and to a discussion of the problems that are now being solved or that ought to be solved in the near future.

In order to give the reader some idea of the nature of the questions discussed, a few of the more interesting ones will be mentioned. In the chapter on physical conditions for image formation the modern method of attacking the problems of spherical and chromatic aberration is discussed. The chapter on interference contains a presentation of the manner in which interference is used for obtaining high spectroscopic resolution by introducing a great difference of path between the two interfering beams, and discusses the problems of molecular vibrations to which this use of interference leads. The chapter on diffraction takes up not only the regular treatment of the grating, etc., but also goes into the question of resolving power in general, and the limit of resolution of optical instruments. In the chapter on absorbing media the reader learns of the optical properties of the metals and of the relations that have been established and proposed between the optical and electrical constants. The chapter on dispersion is particularly well done. Starting with the assumption that the smallest particles of a body possess natural periods of vibration, Professor Drude shows how these natural periods of the particles are involved with the period impressed upon the body from without and the index of refraction and the dielectric constant in determining when the dispersion is normal and when anomalous. He also shows how from the observed dispersion, together with other optical and electrical constants of a substance, the position of the absorption bands may be calculated. In the chapter on bodies in motion the reader is introduced to the present state of scientific opinion upon the questions: 'Is the ether at rest? Is its state of rest disturbed by the motion of matter through it?' His attention is also called to the points that need further investigation and discussion. The last portion of the book is given up to a presentation of the relations that have been discovered between thermodynamics and optics. Here important questions concerning the efficiency of a source of light and the conversion of other forms of energy into light are discussed. The last chapter takes up the properties of incandescent vapors and gases and presents the electron theory, calculating the probable size of an electron from optical data. This last portion of the book contains descriptions of work and theories that are not discussed extensively in any other English text.

A glance at the list of questions just pre-

sented must convince the reader that the topics discussed in the book are not only most interesting, but are also those with which science is to-day grappling. The method of presentation is also forceful, since it gains power and simplicity because of the unifying influence of the great theory that pervades it throughout. By thus giving a coherent treatment of the problems that are in process of solution at the present moment, Professor Drude has produced a book that is bound to have great influence for good upon the science of optics, since it must impress the student that, to use the author's own words, 'optics is not an old worn-out branch of physics, but in it there pulses a new life.'

In doing this the author has in addition given a valuable hint to writers of texts—for how much greater would be the interest in physical science among the people generally if many of the time-worn, cut-and-dried (particularly dried) discussions that have clung tenaciously to the texts could be rewritten so as to present the subject entirely from the present and future point of view instead of from that of the past? In such a presentation stress would be laid, as Professor Drude has done, not only upon that which had been settled, but also upon that which still remains to be settled; so that the reader would not be tempted, after reading the book, to think that he knows it all, since everything is finally settled and he can and has committed it to memory.

Thus all students of physics owe a debt of gratitude to the author of this 'Theory of Optics,' not only because he has woven together for them the scattered threads of the electromagnetic theory into a web of pleasing and symmetrical pattern, but also because he has, in so doing, shown how to present a scientific subject in such a way that the student is left with a realization of the fact that the science is alive and teeming with future possibilities, instead of with a feeling of disgust at having had thrust upon him the usual glorified and embalmed image of past grandeur—a corpse fixed in death.

Thus this work impresses us as a very able and original presentation of a difficult subject. We, therefore, welcome it as a distinct addition to the literature of optics. We congratulate the publisher on having made this book accessible to those to whom German is a barrier. They could perform another service to science if they could persuade Professor Drude to revise his earlier work on the 'Physics of the Ether,' for this work helps much in the understanding of his 'Theory of Optics.'

C. R. Mann.

University of Chicago,
September, 1902.

Medical Microscopy. By T. E. Oertel, M.D. Philadelphia, P. Blakiston's Son & Co. 1902. Small 8vo. Pp. 362.

The facts which a working knowledge of microscopy may reveal to aid in diagnosis are so important that the profession demands an acquaintance with this subject which is coming to be recognized more and more as fundamental in medicine.

This small volume is offered in response to a legitimate voice, as the author believes, coming especially from that part of the medical profession which graduated before much instruction was given in the subjects in which the microscope serves so great a purpose.

Naturally the microscope is the first to receive attention. The various parts are named and their functions explained. The terms used in manipulation are defined and some of the phenomena are considered.

The summary of the facts regarding the habitat, pathogenesis, morphology and cultural characteristics of many of the more important pathogenic bacteria will be of much assistance to those unfamiliar with the subject. The following topics are also briefly treated: preparation of tissue, tumors, blood and the various secretions and excretions of the body.

An author is certainly justified in compiling a work upon medical microscopy in order that the rudiments of the somewhat scattered knowledge may be accessible to all, yet, on the other hand, when such a book compiled from works upon subjects which are experiencing such rapid changes and additions reaches the reader, there will be an opportunity to take exceptions to certain portions of it. This

book is unfortunate in this respect. The technique suggested in many cases, doubtless, will not be received with favor by experienced laboratory workers.

Claim to originality is made by the author with respect to the presentation of the subject only. On the whole, the book is written in a style which is clear and concise. Some of the unqualified statements should be modified to meet the prevailing opinion of to-day. To aid in a future edition we should call attention also to the lettering of the diagrams to represent optical phenomena of the microscope, which we believe to be inadequate and confusing.

A book compiled on the plan of this one will do good service in the place to which the author in the preface modestly assigns it: 'It is to the beginner in microscopy, and particularly to him who must work without the personal guidance of a teacher, that the book may prove of value.'

G. FRANKLIN WHITE.

SCIENTIFIC JOURNALS AND ARTICLES.

The American Journal of Mathematics for October contains the following articles: 'The Plane Geometry of the Point in Point-Space of Four Dimensions,' by C. J. Keyser; 'On the Functions Representing Distances and Analogous Functions,' by H. F. Blichfeldt; 'Surfaces whose Lines of Curvature in One System are Represented on the Sphere by Great Circles,' by L. P. Eisenhart; 'On the Invariants of a Homogeneous Quadratic Differential Equation of the Second Order,' by D. R. Curtiss; 'Surfaces of Constant Mean Curvature,' by L. P. Eisenhart.

SOCIETIES AND ACADEMIES.

MICHIGAN ORNITHOLOGICAL CLUB.

AFTER a few years of apparent sleep, the Michigan Ornithological Club was reorganized at Detroit on February 13, 1903. The officers elected for the current year are: *President,* Adolphe B. Covert, Ann Arbor; *Vice-President,* Dr. Phillip E. Moody, Detroit; *Secretary-Treasurer,* Bradshaw H. Swales, Detroit. Two permanent committees were created. The committee on Geographical Distribution consists of Dr. Charles C. Adams (chairman), Ann Arbor; Professor Walter B. Barrows, Agricultural College; Bryant Walker and B. H. Swales, of Detroit. The Bird Protection Committee consists of Edward Arnold (chairman), Battle Creek; Professor Walter B. Barrows, Agricultural College; James B. Purdy, Plymouth, to act in conjunction with Wm. Dutcher, chairman of the Protection Committee of the American Ornithologists' Union.

It was decided to continue the former club journal styled the *Bulletin of the Michigan Ornithological Club,* three numbers of which (Vol. IV.) have appeared so far. Alexander W. Blain, Jr., was made editor and business manager, and later J. Claire Wood, of Detroit, and Adolphe B. Covert, of Ann Arbor, were elected associates. The *Bulletin* is published by the club at Detroit as an illustrated quarterly devoted to the ornithology of the Great Lake region.

The prospects for the Ornithological Club in the Wolverine state seem most bright, and the society already has over one hundred members enrolled. Monthly meetings are held on the first Friday of each month at the Detroit Museum of Art and annual meetings will be held at the same time and place as the annual meeting of the Michigan Academy of Science.

ALEX. W. BLAIN, JR.

DETROIT COLLEGE OF MEDICINE.

DISCUSSION AND CORRESPONDENCE.

MICHIGAN PLANT SOCIETIES AGAIN.

THE thorough remodeling which my paper on the upland plant societies of Kent County, Mich.,* received at the hands of Mr. Francis Daniels in SCIENCE for August 14, 1903, makes this note by the author seem necessary. In the first place, I hasten to acknowledge with thanks the two very bad blunders which the reviewer has pointed out. *Quercus ilicifolia* should read *Q. prinoides,* and *Vitis cordifolia* should be replaced by *V. riparia.*

In the original paper the author expressly

* Annual Report State Board of Geol. Survey, Mich., 1901, pp. 81–103. *Botanical Gazette,* **35**: 36–55. 1903.

denied all pretense to finality of conclusions; it was to get light on just those subtile changes of soil, etc., to which Mr. Daniels alludes, that the work was undertaken. Thus the criticism that we can not point out any single cause for any difference in vegetation is hardly to the point. My critic deals only with the societies, he is willing to leave the description of soils as it was published.

That the societies used are not of equal rank was pointed out by the author. Increased complexity would doubtless be accompanied in some measure by increased accuracy, but the main points would thus be almost surely lost sight of in the maze of classification. The systematist born and bred can seldom understand the horribly slipshod ways of the ecologist! The fact that Mr. Daniels puts the beech-maple and the maple-elm-agrimony societies together shows clearly that he has failed to study the southern townships. Farther north these types do tend to merge, but southward, into Indiana and Illinois, they are still distinct, as more recent studies by the author show. Likewise, the combining of the oak-hickory with the oak-hazel society indicates failure to study well the condition of things in the northern part of the county. The presence or absence of hickory in this region involves one of the most important ecological questions, one which we can not interpret clearly as yet, but one which it can do no good to slur over. On the whole, my critic's description agrees fairly well with the conditions in the central townships, but fails altogether to express the facts throughout the county as a whole. This is one of the dangers which he might be warned against, namely, that of generalizing from too small an area, no matter how many years he has botanized in it. The author must admit that he, too, is a native of Kent County, and that he has studied its flora for many years.

Bidens frondosa and *Solanum nigrum* are 'frequent everywhere' only in the moister soils of the Grand River valley. *Nepeta, Phytolacca* and *Euphorbia corrallata* are, throughout the area, among the most constant and characteristic members of their societies; they are not weeds excepting in areas where they originally occurred. *Echinospermum* occurs in the lowlands, a fact which may have misled Mr. Daniels, but on the uplands it is a truly characteristic plant of the most mesophytic society. Regarding the distribution of *Cenchrus* there is need of more study than either Mr. Daniels or myself has yet accomplished. Wherever it comes from, it certainly occurs only on the worst sands, *i. e.*, only in the most xerophytic group. Occasional plants of *Dracocephalum* are to be found in the beech and maple forests south of the Grand River valley.

The societies are based on forms which are evident the year round, not on summer forms nor spring forms. Of the 140 forms listed, no less than 40 are spring-flowering. There doubtless are well-marked societies of Thallophytes and Bryophytes, but those of the two higher groups are the ones chosen for study. An adequate study of the distribution of grasses and sedges will be a work by itself when the right student undertakes it. These plants were purposely omitted from the paper under discussion.

BURTON EDWARD LIVINGSTON.

THE NEW YORK BOTANICAL GARDEN,
September 15, 1903.

SHORTER ARTICLES.

FOUR NEW SPECIES OF THE CENTRAL AMERICAN RUBBER TREE.

THOUGH still in the initial and experimental stage, the cultivation of rubber-producing trees is now attracting more general attention than any other branch of tropical agriculture. Large amounts of American capital are being invested in Mexico and Central America, and the practicability of rubber culture in the tropical islands of the United States is receiving the attention of the Department of Agriculture. The first studies have been directed to the Central American rubber tree (*Castilla*), and one of the facts established is the existence of several different local types, instead of a single species extending from Mexico to Bolivia, as hitherto supposed. The species of Castilla are among

the many plants for the study of which the usual dried and shriveled herbarium material is nearly worthless, but in deference to current botanical opinion the public has continued to infer that rubber planting is equally practicable in all localities in which wild trees are found, and that all trees are equally suitable for cultivation, except the elusive 'tunu' or 'ule macho' (male rubber), which Hemsley has recently attempted to separate as a distinct species.

Until the intervening territory has been thoroughly explored it can not be known with certainty whether two supposed species from distinct localities intergrade or not, but for agricultural purposes this is a matter of little importance. There are at least two different kinds of *Castilla* in cultivation in Mexico and two in Costa Rica, and the indications are that these four are distinct species. The *Castilla* introduced from Panama to Ceylon and other British colonies represents a fifth type, while three others are of merely botanical interest, as yet, since they are not known to produce commercial rubber.

Before touching upon the characters which distinguish the species, it may be well to explain that *Castilla* is partially diœcious, somewhat after the manner of the edible fig. The inflorescence consists, as in the fig, of a fleshy receptacle which bears either stamens or pistils; the pistillate inflorescence is turbinate, the staminate more or less flabellate or funnel-shaped. There are trees which bear only male inflorescences, or at least there are some which bear crops of males without females, but along with the females there are also male inflorescences, smaller and generally of a different shape from those of the male trees. The primary male inflorescences arise normally in groups of four, but of the secondary or complemental male inflorescences, those which subtend the females, there are never more than two, as though the female inflorescence were the equivalent of two male clusters.

The original description of *Castilla elastica* (the name *Castilloa* being an unwarranted emendation) was not accompanied by any indication of a definite locality, but there is every probability that Cervantes had reference to the *Castilla* of eastern Mexico, which seems to differ from all of its relatives in its robust habit and in the large size of its ripe fruits, which also have numerous and very distinct vertical grooves. Cervantes' plate shows, in addition, long, slender complemental male inflorescences.

The *Castilla* of the Soconusco district of the state of Chiapas (*C. lactiflua*) is peculiar in having the complemental inflorescence flattened and with a broad mouth; it is very similar to the primary except in the smaller size. The specific name alludes to the fact that the milk of the tree flows freely when the bark is cut, so that it can be collected in quantity and coagulated by improved 'creaming' methods instead of the rubber being harvested wholly or partly by pulling the 'scrap' (burucha) from the gashes in which it has dried. Large yields of scrap rubber are sometimes reported from wild trees, but the tapping to which they are subjected is very severe, and the removal of the rubber from the wounds delays healing and exposes the tree to the attacks of insects, so that the cultural production of scrap rubber is not likely to be profitable.

On the peninsula of Nicoya, which extends into the Pacific Ocean from the northern part of Costa Rica, is a rubber tree easily recognized by the dark olive color of its inflorescences of both sexes, and by the deeply bilobed, long-stalked primary male inflorescence; the complemental inflorescences are also long and slender and are usually grown together at the base. The branches, leaves and floral organs are also much more densely hairy than those of the *Castilla* or of the more humid eastern slope of Costa Rica (*C. costaricana* Liebmann). In *C. nicoyensis* the individual fruits are very prominent, as in the two Mexican species, but in *C. costaricana* they are separate only at the broadly rounded or flattened apex, leaving no characters by which Hemsley's *Castilla tunu*, from British Honduras, can be distinguished, except the reputed deficiency of rubber, which is by no means lacking in *C. costaricana*. It seems certain, however, the 'tunu' tree which Hemsley has recently figured and described from

materials collected by Professor H. Pittier at 'Quebrado de Potrero Grande,' in southern Costa Rica,* is quite distinct from the Belize *tunu*. The branches, leaves and fruits are only slightly hairy, the fruits, fruit-clusters and seeds are smaller, and the individual fruits are distinct to near the base. Professor Pittier also informs me that the habit of the tree is different from that of *C. costaricana*, and that the fruits do not become fleshy and soft with maturity, but simply dry up. The milk does not yield an elastic gum, but hardens into a substance which the natives call 'gutta-percha.' Since Hemsley refers to previous figures and descriptions by Hooker and himself as representing the Belize *tunu*, and places British Honduras as the first locality, it seems that the name *Castilla tunu* belongs to the more northern tree; for that of southern Costa Rica the name *Castilla fallax* is suggested.†

* Icones Plantarum, 7: pl. 2651. 1900.

† The diagnostic characters of the several species of *Castilla* are summarized in the following analytical key:

Pistillate inflorescence with a thick stipe 18–25 mm. long; stigmas short, cushion-shaped; pistils distinct to base. *Castilla australis* Hemsley; Peru.

Pistillate inflorescence sessile; stigmas slender; pistils coadnate, at least at base.

Primary male inflorescence with a distinct slender stipe 15–20 mm. long; deeply bilobed and opening widely with maturity. *Castilla nicoyensis* sp. n.; Nicoya Peninsula.

Primary male inflorescence broadly flabellate, gradually narrowed to the short stipe; not bilobed, opening only by a longitudinal slit.

Complemental inflorescence flabellate, broad and flattened like the primary, and with a broad longitudinal opening. *Castilla lactiflua* sp. n.; Soconusco, Mexico.

Complemental inflorescence obconic or pyriform, with a central aperture.

Ripe fruits very large and prominent, with numerous deep vertical grooves. *Castilla elastica* Cervantes; eastern Mexico.

Ripe fruits less prominent, the grooves shallow or wanting.

Leaves not cordate at base; leaves, branches and fruits nearly glabrous; fruits becoming tough and dry with maturity; seeds round, 6–7 mm. in diameter, male flowers with two stamens adnate at base. *Castilla fallax* sp. n.; southwestern boundary of Costa Rica.

Leaves distinctly cordate at base; leaves, branches and fruit densely hirsute, fruits becoming soft and deep orange or red with maturity; seeds oval or flattened 8–12 mm. in diameter; stamens 2 or 3, free.

Ripe fruits with prominent acute tips. *Castilla panamensis* sp. n.; Panama.

Ripe fruits with apices broadly rounded or flattened. *Castilla costaricana* Liebmann; eastern Costa Rica.

Some of Hooker's figures* ascribed to *Castilla elastica* may possibly represent *C. fallax*, but not those called *tunu* by Hooker and Hemsley. It seems, then, that the flat-fruited *C. tunu* Hemsley, from Belize, may be merely a subspecies under the older name *costaricana*. The Panama *Castilla* is also obviously related to *costaricana*, but the sharply pointed fruits may characterize a second subspecies, *C. panamensis*, of which Hooker published an elaborate plate based on drawings made in Ceylon.†

Four other specific names have been used under *Castilla*. *C. markhamiana* Collins has been assigned by Hooker and Hemsley to the allied genus *Perebea*. Koschny's *C. alba*, *C. rubra* and *C. nigra*, from northeastern Costa Rica, seem likely to prove synonyms of *C. costaricana*. The bark characters relied upon by Herr Koschny ‡ as diagnostic are explainable on other grounds than that they constitute specific or even varietal differences.

The existence of numerous species and varieties of *Castilla* shows that careful discrimination will be necessary in selecting the type best adapted for cultivation in Porto Rico and the other tropical islands of the United States. It shows, too, that the rather ad-

* *Trans. Linn. Soc. London*, 2d series, **2**: 209, pl. 28, figs. 4–6. 1885.

† *Trans. Linn. Soc. London*, 2d series, **2**: 209, pl. 27. 1885.

‡ 'Beihefte zum Tropenpflanzer,' **2**: 124. 1901.

verse results of the East Indian experiments with *C. panamensis* may not apply to the whole genus. Moreover, during the present study of the subject many reasons have been found for believing that the conditions under which *Castilla* has been tested in the East Indies are not really favorable to the production of rubber; the current idea that a continuously humid climate is required is erroneous. In short, it appears that we are still at the beginning of a scientific comprehension of the factors which determine the practicability and profitability of rubber culture. It has been ascertained that rubber can be produced agriculturally, but where, how and what to plant, and how, how much and how long we shall harvest, are questions largely answered, as yet, by speculation rather than by experiment. O. F. COOK.

U. S. DEPARTMENT OF AGRICULTURE.

THE NAME OF THE BREADFRUIT.

THE genus *Artocarpus* was first described in 1776 by G. and G. J. R. Forster in the 'Characteres Generum Plantarum,' a work written as a result of their botanical studies made during Captain Cook's second voyage into the Pacific and round the world between 1772 and 1775. The combination *Artocarpus communis* was given in this work for the breadfruit tree, a name which, according to nomenclatorial rules, must replace the generally accepted *Artocarpus incisa,* which was not published by the younger Linnæus until 1781.*

Forster's genus was, moreover, published as a monotype, and as his plants were from the Society Islands there can be no doubt but that he was dealing with the true breadfruit. He did not publish, it is true, any specific description, leaving all for the genus, but he did make a good binomial combination and had two good plates which are generally considered sufficient to establish a name in good standing.

Thunberg later in the same year (1776) published the names *Radermachia incisa* and *integrifolia* for the bread- and jak-fruits respectively from material collected in the East Indian Islands. Five years afterwards the younger Linnæus made his new nomenclatorial combinations on this material of Thunberg, adopting Forster's generic name and adding to it Thunberg's specific designations, and taking the credit to himself.

Further complications are met with when it is found that in the subsequent works of the Forsters, when mention is made of the breadfruit, the specific name *incisa* is used. Why they should abandon their own name is rather difficult to understand unless it was a case in which 'the king can do no wrong.'

Dr. A. Richter is fully alive to the injustice done Forster and has published a note* on the history of the name of the breadfruit which adequately states the facts in the case and further calls attention to the unfortunate revival by O. Kuntze of the pre-Linnæan name of *Soccus,* a relic of Rumphius, and of his combining with it Forster's specific name. Yet Rumphius published a specific name for the breadfruit which Kuntze has, for no apparent reason, seen fit to ignore.

A. Engler, acting on this note, has corrected in the 'Nachtrag' to the 'Natürlichen Pflanzenfamilien' the name of the breadfruit as it appears in the text of that work, and states that *Artocarpus communis* is the correct designation. HENRY E. BAUM.

U. S. DEPT. AGRICULTURE.

* 'Suppl.' 411. 1781.

* *Botanisches Centralblatt* 60: 169–170. 1894.

EUCALYPTS IN THE PHILIPPINES.

THE eucalypts, of which but comparatively few species are familiarly known outside of their native home, include some one hundred and fifty species or more, nearly all restricted to Australia and Tasmania. Many of the forms may be classed as shrubs, others attain great size, surpassing in height, as has been stated on good authority, the giant Sequoias of California, though not equaling them in diameter or girth. A few species have been found elsewhere, viz., in New Britain, New Guinea and Timor, islands north of the Australian continent, between latitude 10° S., and the equator. It is not unlikely that sooner or later other species, at present unknown, will be detected on some of the multi-

tude of islands, large and small, that occur between latitude 10° S., and 20° N. and longitude 90° to 170° E. From New Britain in the Bismarck archipelago midway between latitude 10° S. and the equator, to Mindanao, the most southern of the Philippines between latitude 5° and 10° N., situated to the northwest of New Britain, is quite a leap, as will be perceived by a moment's thought. The occurrence of *Eucalyptus* in the Philippine island above named has recently been verified by Mr. Maiden, the director of the Botanic Gardens, Sydney, N. S. W., who has examined the specimen collected by William Rich, the botanist of the U. S. ship *Relief* of the famous Wilkes* Exploring Expedition, who collected the plant or example, near Caldero, Mindanao, some time between 1838 and 1842, and named it *E. multiflora;* it proves, however, to be identical with *E. naudiniana* F. v. Müller.† Rich's name being preoccupied explains the change of name. *E. naudiniana* occurs in New Pommern (New Britain) 'and is so common in the forests that two saw-mills have been started especially for the timber, which is not hard as the Australian *Eucalyptus*, but still good useful timber.'‡

Robt. E. C. Stearns.

Los Angeles, Cal.,
August 15, 1903.

* *Proc. U. S. National Museum*, Vol. XXVI., p. 691.

† *Id.*, p. 692.

‡ As Mr. Maiden says: "There are so few Eucalypti found outside of Australia that the question of the identity of one found beyond the limits of that continent is of interest, and the occurrence of the genus in the Philippines is now set at rest, and doubtless its range in that group will be ascertained by American botanists."

QUOTATIONS.

LORD SALISBURY AS A MAN OF SCIENCE.

It is generally understood that the branch of science which Lord Salisbury loved best was chemistry, and the freedom with which he discussed chemical questions gives weight to the suggestion. Besides, it is well known that he spent much time in his laboratory in Hatfield House, where, however, he directed his attention also to engineering and electrical problems. He conceived the idea of utilizing the flow of the River Lea for the electric lighting of the house, and the provision of a water supply to the town of Hatfield from the mains of Hatfield Park was due to his thought and kindliness.

In many ways he showed that his love of science had practical as well as academic leanings, but he made no original communication on scientific subjects to the learned societies. He was elected to the fellowship of the Royal Society in 1869, and almost immediately became a member of the council. He took a keen and active interest in the internal affairs of the Royal Society, for he served on the council in 1882–3, and again in 1892–4. He was vice-president also in 1882–3, and in 1893–4. And almost his last public act was associated with science and not with politics, for on the occasion of the election of the Prince of Wales to the fellowship of the Royal Society in April last it was Lord Salisbury who introduced him to the president and fellows.

Lord Salisbury's character as a man of science deservedly secured for him the particular respect and admiration of our profession, though it must be confessed that he made no bid whatever for our favor. Lord Salisbury's name is not associated with a singular popular measure of the kind that would be sure to win medical approbation. But medical men could see in his attitude toward life the trained and austere thinker. He did not speak if he did not know; he would not proceed to the next step till he had verified the one on which progress should depend; and, having convinced himself in which direction truth lay, he would hold firmly to his convictions.—*The Lancet.*

CIVIL ENGINEERS OF THE NAVY.

The civil engineers of the navy seem to have a substantial grievance. The service has grown and with it the duties of these dockyard officials. Our navy repair shops do an infinitely larger business than at any time since the war for the union. The civil engineer at Norfolk, for instance, has under his charge public works involving an expenditure of $2,700,000, and is also responsible

for the repairs to and preservation of property valued at $2,500,000. His brother officer at New York is supervising the investment of appropriations amounting to $4,500,000, and is responsible for property estimated to be worth $7,000,000. Yet his rank is only that of a lieutenant-commander, while the officer at Norfolk is merely a junior lieutenant. It is also a fact that there are but thirty-one officers in the corps, of whom one is Peary, who has been away from his regular duties, in the interest of science, for a number of years and who is about to go again. Promotion, too, is very slow. As the corps now stands, two of the junior lieutenants will not become full lieutenants until the age of fifty-nine, when they may, perhaps, be grandfathers. Altogether, it seems plain that if more rank and pay are to be bestowed anywhere in our rapidly expanding navy the civil engineers ought to be the first considered. Efficient men in this corps should mean better navy yards and docks, and so greater economies in the interest of the taxpayers.—New York *Evening Post.*

GEOLOGICAL EXPLORATIONS IN EGYPT.*

Thanks to the munificence of Mr. W. E. de Winton, who generously undertook to defray the entire cost of carrying on for one or two seasons geological explorations in the Libyan Desert, the trustees of the British Museum have been enabled, as the result of the past season's operations, to enrich considerably the national collection of fossils in the Natural History Museum. Dr. C. W. Andrews, of the geological department, was again sent on this mission, and he received valuable assistance from Captain H. G. Lyons, director-general of the Egyptian Geological Survey, and other officers of the survey. Dr. Andrews proceeded to the Fayûm and began work in the district to the north of the lake Birket-el-Kerun; and here he secured a fairly large collection of vertebrate remains, including several new forms and some specimens of great scientific interest, nearly all the bones being of Upper Eocene age.

* From the London *Times*.

The most important object obtained is a very fine and almost complete skull and mandible of a large, heavily-built ungulate, the first specimen of which was discovered two years ago by Mr. H. J. L. Beadnell, of the Egyptian Geological Survey, who called the genus *Arsinoitherium* (after Arsinoë, a queen of the Fayûm in the 3d century B. C.), naming the species Zitteli, after Professor K. von Zittel, the distinguished paleontologist at the University of Munich, and a pioneer of geological exploration in the Libyan Desert. *Arsinoitherium* probably resembled in general appearance a big rhinoceros, though in no way related to that animal. The form of the bones of the feet and legs suggests that it was most nearly allied to the elephants and to the Dinocerata, a remarkable group of huge extinct herbivorous hoofed mammals, remains of which have been found in great abundance in the Eocene Tertiary strata of Wyoming, North America; but in the possession of a pair of great bony horns over the nose, together with a smaller pair over the eyes and in the peculiar form of the teeth *Arsinoitherium* stands quite apart from other mammals.

Dr. Andrews also came across a very large mandible and a maxilla, both with well preserved teeth, which have characters indicating the existence of a species of *Arsinoitherium* much bigger than the one named after Zittel.

Of the early and primitive forms of Proboscidea a considerable series of specimens was acquired for the national collection at South Kensington. Mention may be specially made of a nearly complete skull of *Paleomastodon*, one of the early forms of the elephant family lately found in the Eocene beds of Egypt. It is of interest to note that most of the characters which give to the skull and teeth of the modern elephant their peculiar structure and appearance have in *Paleomastodon* only just begun to develop. Thus as regards the teeth, the grinders are much simpler than in later forms, and consist of three transverse ridges only. Moreover, all the cheek-teeth (premolars and molars) are in wear at once, as in ordinary mammals, while in the recent elephants the front cheek-teeth fall out before the hinder ones are cut. The shortening

of the face and the swelling up of the hinder part of the skull are connected with the development of the heavy tusks and trunk of the present day elephant; but in *Paleomastodon* these structures were comparatvely small, and the animal must have presented much the appearance of a very large pig.

Peculiar interest attaches to the discovery of bones of a large Hyracoid about the size of a tapir, belonging to a new genus. It is only within recent years that fossil remains of this group of mammals, whose affinities have long been a puzzle to zoologists, have been described. Dr. Andrews relates the occurrence in these beds of four other species of *Hyraces;* and this fact would seem to indicate that the comparatively few and insignificant modern members of the group are the degenerate descendants of a once numerous stock which must at that time have been an important factor in the Ethiopian fauna.

The sands and clays in which these bones and fossilized trees are embedded in such abundance are evidence that in Eocene times this part of the Libyan Desert was the estuary of a great river, down which the carcasses of drowned animals, accompanied by big tree-trunks, were swept, and then buried in mud and sand.

Dr. Andrews also obtained a collection of specimens from the Pleistocene lake-beds of Birket-el-Kerun, including numerous flint implements and remains of an animal which he has identified as belonging to the African elephant (*Elephas Africanus*). The occurrence of elephant remains in this locality associated with flint implements is, as Dr. Andrews points out, very noteworthy, both as extending the known range of the African elephant and also as supplying a strong reason for regarding the implements as being of prehistoric age. Dr. Budge states that no representation of the elephant is met with on any of the early Egyptian monuments, which certainly would not be the case had the artists been familiar with the animal; and it is therefore probable that it became extinct in Egypt at some remote prehistoric period, when also the implements which were found with the remains must have been made.

The imposing-looking skull of *Arsinoitherium Zitteli* and specimens of *Paleomastodon* are now exhibited in the Central Hall of the Natural History Museum.

Mention may also be made here of other recent important additions to the exhibited collection in the gallery of fossil mammalia. These comprise a series of remains of mammals from the Lower Pliocene formation of Pikermi, near Athens, obtained during the excavations recently undertaken by the trustees at that place. The bones exhibited are only a small portion of the large collection secured by Dr. A. S. Woodward. They represent quadrupeds which were living in Greece in the Lower Pliocene period, when that country was connected by land with Asia and Africa, before the Mediterranean assumed its present form. Greece was then a land of forests, table-lands and lakes; and Pikermi is part of the bed of a silted-up lake, into which the bones of accidentally destroyed herds of quadrupeds were washed and buried. The remains shown at South Kensington belong to primitive elephants (*Mastodon*), rhinoceroses, three-toed horses (*Hipparion*), numerous antelopes, giraffes, pigs, hyenas and monkeys. Attention should be drawn to the instructive pieces of the bone-beds showing how the fossilized remains occur in the rock.

THE ELIZABETH THOMPSON SCIENCE FUND.

This fund, which was established by Mrs. Elizabeth Thompson, of Stamford, Connecticut, 'for the advancement and prosecution of scientific research in its broadest sense,' now amounts to $26,000. As accumulated income will be available January next, the trustees desire to receive applications for appropriations in aid of scientific work. This endowment is not for the benefit of any one department of science, but it is the intention of the trustees to give the preference to those investigations *which can not otherwise be provided for,* which have for their object the advancement of human knowledge or the benefit of mankind in general, rather than to researches directed to the solution of questions of merely local importance.

Applications for assistance from this fund, in order to receive consideration, *must be accompanied by full information*, especially in regard to the following points:

1. Precise amount required. Applicants are reminded that one dollar ($1.00 or $1) is approximately equivalent to four English shillings, four German marks, five French francs, or five Italian lire.

2. Exact nature of the investigation proposed.

3. Conditions under which the research is to be prosecuted.

4. Manner in which the appropriation asked for is to be expended.

All applications should reach, before January 1, 1904, the Secretary of the Board of Trustees, Dr. C. S. Minot, Harvard Medical School, Boston, Mass., U. S. A.

It is intended to make new grants in January, 1904.

The trustees are disinclined, for the present, to make any grant to meet ordinary expenses of living or to purchase instruments, such as are found commonly in laboratories. Decided preference will be given to applications for small amounts, and grants exceeding $300 will be made only under very exceptional circumstances.

(Signed)

HENRY P. BOWDITCH, *President*,
CHARLES S. RACKEMANN, *Treasurer*,
EDWARD C. PICKERING,
THEODORE W. RICHARDS,
CHARLES-SEDGWICK MINOT, *Secretary*.

September, 1903.

Grants made prior to 1900 have already been printed in SCIENCE. The following grants have since been made.

1900.

86. $200, to Dr. H. H. Field, Zürich, Switzerland, to aid in the publication of a card catalogue of biological literature.

87. $500, to S. H. Scudder, Esq., Cambridge, Mass., for the preparation of an index to North American Orthoptera.

88. $300, to Professor P. Bachmetjaw, Sofia, Bulgaria, for researches on the temperature of insects.

89. $250, to Dr. E. S. Faust, Strassburg, Germany, for an investigation of the poisonous secretion of the skin of Amphibia.

90. $250, to Professor Jacques Loeb, Chicago, Ill., for experiments on artificial parthenogenesis.

91. $650, to the National Academy of Sciences, Washington, D. C., towards the expenses of three delegates to attend the conference of academies at Wiesbaden in October, 1899, to consider the formation of an International Association of Academies.

1901.

92. $150, to Professor E. W. Scripture, New Haven, Conn., for work in experimental phonetics.

93. $300, to Professor W. Valentiner, Heidelberg, Germany, for observations on variable stars.

94. $50, to A. M. Reese, Esq., Baltimore, Md., for investigation of the embryology of the alligator.

1902.

95. $125, to F. T. Lewis, M.D., Cambridge, Mass., for investigation of the development of the vena cava inferior.

96. $150, to Professor Henry E. Crampton, New York, for experiments on variation and selection in Lepidoptera.

97. $100, to Professor Frank W. Bancroft, Berkeley, Cal., for experiments on the inheritance of acquired characters.

98. $250, to Professor John Weinzirl, Albuquerque, N. M., for investigation of the relations of climate to the cure of tuberculosis.

99. $300, to Professor H. S. Grindley, Urbana, Ill., for investigation of the proteids of flesh.

100. $300, to Dr. Herbert H. Field, Zürich, Switzerland, to aid the work of the Concilium Bibliographicum. (An additional grant of $300 was made June, 1903.)

101. $250, to Dr. T. A. Jaggar, Cambridge, Mass., for experiments in dynamical geology.

102. $50, to Professor E. O. Jordan, Chicago, Ill., for the study of the bionomics of *Anopheles*.

103. $300, to Dr. E. Anding, Munich, Bavaria, to assist the publication of his work, 'Ueber die Bewegung der Sonne durch den Weltraum.'

104. $300, to Professor W. P. Bradley, Middletown, Conn., for investigations on matter in the critical state.

105. $300, Professor Hugo Kronecker, Bern, Switzerland, for assistance in preparing his physiological researches for publication.

106. $300, to Professor W. Valentiner, Heidelberg, Germany, to continue the work of Grant No. 93.

OBSERVATORY AND PHYSICAL LABORATORY AT WASHBURN COLLEGE.

Washburn College Observatory, Topeka, Kansas, was dedicated September 18. The address was delivered by Professor C. L. Doolittle of the Flower Observatory. The equipment now comprises the 11½-in. 'Grand Prix' refractor exhibited by Warner and Swasey at the Paris Exhibition, a five-inch photographic doublet, 7-centimeter combined transit and zenith telescope, sextant, mean time break circuit chronometer and a standard chronograph. There will be added at once a mean time and a sidereal clock, a position micrometer, a computing machine and a working library of star charts and catalogues, tables, standard works of reference and observatory publications. Provision is also made for a meridian circle and spectroscopic outfit. The dome is a 26-foot, copper covered, by Warner and Swasey. There is a dark room, a clock and reception room, an apparatus room, library and computing room, and recitation room. Adjacent to the observatory are the new physical laboratories and mathematical rooms. On the ground floor are the heat and electrical laboratories and shop; on the main floor the lecture-room, apparatus room, offices, general laboratory, light and spectroscopy room and a room for special or advanced work. Both the observatory and the laboratories are the gift of an eastern man who has not allowed his name to be announced in connection with the gift.

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The attendance at the Southport meeting of the British Association was 1,754, consisting of 250 old life members, 21 new life members, 319 old annual subscribers, 90 new annual subscribers, 688 associates, 365 ladies, and 21 foreign members. This is slightly larger than the attendance at the Belfast meeting last year and is not far from the average of recent meetings, but falls short of the attendance of the Southport meeting of 1883 by nearly 1000. The International Meteorological Committee sat during the meeting of the British Association, the members being received by the Mayor of the city, previous to their session. The receipts of the Association last year were £4,117, and the expenditure £3,468, a balance being brought forward from last year of £1,565. The invested funds of the Association amount to £10,101. £2,465 was subscribed locally at the Southport meeting. The list of grants, as reported in the English journals, is as follows:

Mathematics and Physics.

Lord Rayleigh, 'Electrical Standards,' Unexpended balance.

Professor J. W. Judd, 'Seismological Observations,' £40.

Dr. W. N. Shaw, 'Upper Atmosphere Investigations,' £50 and unexpended balance.

Sir W. H. Preece, 'Magnetic Observations,' £60.

Chemistry.

Sir H. Roscoe, 'Wave-length Tables of Spectra,' £10.

Professor E. Divers, 'Study of Hydroaromatics,' £25.

Geology.

Mr. J. E. Marr, 'Erratic Blocks,' £10 and balance in hand.

Dr. R. F. Scharff, 'To Explore Irish Caves,' balance in hand.

Professor W. W. Watts, 'Movements of Underground Waters,' balance in hand.

Mr. J. E. Marr, 'Life Zones in Carboniferous Rocks,' £35.

Professor W. A. Herdman, 'Fauna and Flora of the Trias,' £10.

Mr. G. W. Lamplugh, 'To Investigate Fossiliferous Drifts,' £50.

Zoology.

Professor S. J. Hickson, 'Zoological Table at Naples,' £100.

Dr. H. Woodward, 'Index Animalium,' £60.

Professor W. F. R. Weldon, 'Investigations in Development in the Frog,' £15.

Professor S. J. Hickson, 'Researches on the Higher Crustacea,' £15.

Economic Science and Statistics.

Dr. E. Cannan, 'British and Foreign Statistics of International Trade,' £25.

Mechanical Science.

Sir J. J. Thornycroft, 'Resistance of Road Vehicles to Traction,' £90.

Anthropology.

Sir John Evans, 'Archeological and Ethnological Researches in Crete,' £100.

Dr. R. Munro, 'Researches in Glastonbury Lake Village,' £25.

Professor A. Macalister, 'Anthropometric Investigation on Egyptian Troops,' £10.

Dr. A. J. Evans, 'Excavations on Roman Sites in Britain,' £25.

Physiology.

Professor W. D. Halliburton, 'The State of Solution of Proteids,' £20.

Professor F. Gotch, 'Metabolism of Individual Tissues,' £40.

Botany.

Professor S. H. Vines, 'Completion of Monograph on Potamogeton,' £10.

Professor L. C. Miall, 'Botanical Photographs,' £5.

Professor M. Ward, 'Respiration of Plants,' £15.

Professor M. Ward, 'Experimental Studies in Heredity,' £35.

Corresponding Societies.

Mr. W. Whitaker, £20.

Making a total of £900.

The following resolutions by the committee of recommendations were agreed to:

That, as urged by the president in his address, it is desirable that scientific workers, and persons interested in science, be so organized that they may exert permanent influence on public opinion in order more effectively to carry out the third object of this association, originally laid down by the founders—namely, to obtain a more general attention to the objects of science, and a removal of any disadvantages of a public kind which impede its progress—and that the council be recommended to take steps to promote such organization.

That the council be requested to consider the desirability of urging upon the Government, by a deputation to the First Lord of the Treasury or otherwise, the importance of increased national provision being made for University education.

A resolution was also approved to the effect that the sectional committees should be continued in existence until their successors were appointed, and should be authorized to bring to the notice of the council, in the intervals between the meetings of the Association, any matters in which the action of the council might be desirable. The appointment of twenty-six committees without grants was approved.

The following resolutions presented to the committee of recommendations by section A were approved:

That the attention of the council be called to the utility which would result from obtaining more uniformity in the units adopted in meteorology and to the fact that the moment has come for bringing about such uniformity.

That the systematic investigation of the upper currents of the atmosphere by means of kites or balloons is of great importance to meteorology, and that the council be asked to take such steps as they may think fit to urge upon the treasury the importance of providing the Meteorological Council with the funds necessary for the purpose.

At a meeting of the general committee the names of Professor Simon Newcomb, of Washington, Professor L. Boltzmann, of Leipzig, and Professor Mascart, of Paris, were added to the vice-presidents of Section A. Dr. W. A. Herdman was elected one of the secretaries of the Association in the room of Dr. B. H. Scott. The Association will meet on August 17, 1904, at Cambridge, under the presidency of Mr. Arthur Balfour, the prime minister. The following year the meeting will be in South Africa, the governments of Cape Colony, Natal and other colonies having appropriated £6,000 to assist in the transportation of members.

SCIENTIFIC NOTES AND NEWS.

DR. W. A. NOYES, of the Rose Polytechnic Institute, has accepted the position of chemist in the National Bureau of Standards. During the present year while the laboratories are in course of erection, Professor Noyes will enjoy the hospitality of the Johns Hopkins University.

PROFESSOR GEORGE H. DARWIN, of Cambridge University, has been elected associate of the Belgian Academy of Sciences in the room of the late Professor Stokes.

DR. M. P. RAVENEL has been appointed assistant medical director and chief of the

laboratory of the Henry Phipps Institute for the Study and Treatment and Prevention of Tuberculosis, Philadelphia.

Dr. Andrew D. White, formerly president of Cornell University and ambassador to Germany, has decided to spend the winter in Germany and Italy. He will consequently be unable to give the lectures that had been planned at Yale and Cornell Universities.

Mr. R. S. Williams, museum aid at the New York Botanical Garden, has been sent to the Philippine Archipelago to make collections for the garden.

Dr. F. L. Tufts, tutor in physics in Columbia University, has been given a year's leave of absence to spend in research in Germany.

Dr. Eugene C. Sullivan, of the University of Michigan, and Mr. Waldemar T. Schaller, of San Francisco, have been appointed assistant chemists in the United States Geological Survey. The appointments were made upon the basis of civil service examinations.

Mr. J. C. Cadman has been elected president of the British Institution of Mining Engineers.

Professor Augustus Radcliffe-Grote, director of the Museum in Hildesheim, an authority on entomology, died on September 23. He lived for many years in New York State, being director of the Buffalo Academy of Science.

The death is announced of the Rev. Maxwell Henry Close, at Dublin on September 15, at the age of eighty-one years. He had devoted himself to scientific pursuits since 1861, having published papers on astronomical and other subjects.

The Henry Phipps Institute for the Study, Treatment and Prevention of Tuberculosis has arranged for the coming fall and winter a series of lectures on various phases of tuberculosis. The first of these lectures will be given by Dr. E. L. Trudeau, of Saranac Lake, N. Y., during the last week in October, his subject being 'The History of the Development of the Tuberculosis Work at Saranac Lake.' The following have been invited to give the subsequent lectures: Dr. Pannwitz, of Germany, in November; Dr. William Osler, of Baltimore, in December; Dr. Calmette, director of the Pasteur Institute, at Lille, France, in January; Dr. Herman M. Biggs, of New York, in February, and Dr. Maragliano of Italy, in March. All of them have accepted with the exception of Dr. Calmette, who will come if it is possible.

The American Grape Acid Association, 318 Front St., San Francisco, Cal., offers a premium of $25,000 for any person who devises a process or formula for the utilization of California grapes containing over twenty per cent. of saccharin, worth $10 a ton, to produce tartaric acid at a price that would permit of exportation without loss. The decision in awarding the amount is to rest with a jury of five, of which Professor E. W. Hilgard, of the University of California, is one. The offer closes on December 1, 1904.

A Japanese translation of 'Elements of Sanitary Engineering,' by Professor Mansfield Merriman, has recently been published at Tokio. The translator is B. Onuma, principal of the Kogyokusha Engineering College at Shiba.

A cablegram to the daily papers states that a high speed trial over the Zossen experimental electric railroad on September 26 resulted in attaining a speed at the rate of over 117 miles per hour. Every part of the 100-ton car was intact and the roadbed was not affected.

A correspondent of the London *Times* writes that students of the history and of the prehistoric times of the Scandinavian countries have been much surprised by the recent discovery of an artistically highly-finished 'sun chariot'—a structure of ancient religious and sacrificial import—in a moor of Seeland in Denmark. From the site where it was found it is supposed to be not less than 3,000 years old. It is now in the museum at Copenhagen. The subject is of great interest for the whole Scandinavian and Germanic race.

We learn from the London *Times* that it is stated that a scheme is on foot for the organization of a floating industrial exhibition of British manufactures, which is to make

a tour of the Empire. The movement has the support of prominent shipping and manufacturing firms, but it has not yet taken final shape. The plan which is now in course of development is to fit out a large ship with samples of all classes of manufactured articles which Great Britain supplies or can supply to her Colonies, including even fairly heavy machinery. From 50 to 100 firms are expected to exhibit, and a representative of each firm will accompany the ship, which, in the course of a voyage extending over some six months, will call at every port of importance in the British Colonies and dependencies, as well as in Japan, China and other specially selected places. It is the intention of the organizers to be in a position to sail in the early part of next year.

DR. R. BOWDLER SHARP writes to the editor of the *Times:* In common with many other zoologists, I have been somewhat concerned to see the avidity with which certain journals in this country publish broadcast myths connected with natural history, and the credulity with which nonsensical paragraphs of this kind are received by the public. The myth most in vogue in the springtime is the one that the British Museum is in want of a kingfisher's nest, and has offered a reward of £100 to anybody who will procure one for the national collection. This fable dies hard, and causes me much loss of time every spring in assuring well-meaning collectors that the British Museum has long ago acquired as many kingfisher's nests as it wants. On a par with this foolish myth is another which is now being exploited—viz., the story that a well-known entomologist has paid £1,000 for a specimen of a flea! The journals which print, and the folk who read, this nonsense must surely know it is untrue. The fleas and mosquitoes are both families of insects extremely difficult to study. We know the mischief which is done by mosquitoes in the case of malaria, and the report of the Plague Commission shows that fleas play no unimportant part in the dissemination of disease. To make a collection of these noxious insects is a tedious and difficult matter, but they have to be studied and monographed like butterflies and the higher orders. It is, therefore, annoying to zoologists to find mendacious statements published broadcast which are calculated to bring into ridicule the earnest work which is being carried on by entomologists who devote themselves to the study of these difficult groups. I have heard of one instance when a new and curious genus of *Pulicidæ* was valued at 10s., but, as a rule, the sum of 3d. or 6d. is considered sufficient value by museums for any specimen of fleas obtained from animals in any part of the world. There is, sir, a considerable difference between sixpence and a thousand pounds, and it may be considered that the exposure of such a palpable untruth is not worth the time that it takes to expose it; but the reiteration of the myth in responsible journals, and the credulity of the public, as shown by the correspondence on the subject, make it desirable to give publicity to the true facts of the case.

MR. W. W. HARRIS, U. S. Consul at Mannheim, writes to the Department of State: Beginning with June 7, 1903, a three days' congress of the German Society of Electricians was held in Mannheim. The meetings were attended by about 300 electrical engineers from all parts of the empire. Papers were read on a variety of topics pertaining to electrical engineering, especially as applied to street-railway construction, electric lighting, etc. Among those who presented papers were Privy Councillor Professor Arnold, of Carlsruhe; Professor Görges, of Dresden; and Baron von Gaisberg, of Hamburg. At this meeting, as at similar meetings in Germany, that which first attracts the attention of the observer is the active part taken by teachers from the technical and other schools in what might be regarded the purely practical side of the subject. Thus, in this particular case the discussions led into the construction of street railways, installation of light and power plants, etc. Among those who took a leading part in these discussions were teachers and professional men. No opinion is ventured as to whether, upon the whole, a science such as that of electricity, mining, architecture, etc., progresses more rapidly if left mainly to what

may be termed the self-made unprofessional engineers or if left more under professional or academic control. The German manufacturer or railway builder would doubtless answer the question in favor of the professionally trained expert. The conditions existing in the two countries being in many respects different, the advancement made in electrical engineering, for example, affords no complete answer to the question. It would be conceded on both sides of the ocean that in the more difficult field of chemical manufacture the professionally trained chemist has been indispensable.

The New York State Civil Service Commission will receive until October 10, applications for the positions of instructors in various manual arts in the reformatory and industrial institutions of the state. The salaries are in most cases $65 a month and board. Candidates will not be required to appear at any place for examination but will be rated on their education, special training, experience and personal qualifications as shown by their sworn statements, and by the answers to inquiries made by the Commission of their former employers and others acquainted with their experience and qualifications. Duly authenticated specimens of the work of candidates may also be required to be submitted in conformity to regulations to be prescribed by the Commission.

UNIVERSITY AND EDUCATIONAL NEWS.

The daily papers state that Mr. John Hays Hammond, professor of mining engineering at Yale University, will present to that institution a metallurgical laboratory costing from $25,000 to $50,000.

It is reported that donations amounting to $300,000 have been made to the University of Chicago, for archeological research in Egypt and Babylonia.

It is also reported that the University of Chicago has purchased the south frontage of the Midway Plaisance between Cottage Grove and Madison Avenue at a cost of $1,450,000 and that this land will be used as a medical school including the Rush Medical College and the McCormick Memorial Institute for Infectious Diseases.

The University of Illinois has acquired in connection with the College of Physicians and Surgeons the Chicago College of Dental Surgery.

A press despatch to the daily papers from Des Moines, Ia., states that Mr. Frederick M. Hubbell, has conveyed, jointly with his wife, property to the value of about $5,000,000 to himself and his sons, Frederick C. Hubbell and Grover C. Hubbell of Des Moines, trustees of the said Frederick M. Hubbell estate, and to their successors in trust for the trustees and their lineal descendants, to the State of Iowa, to be used in founding a college in Des Moines. The trust period begins with the date of the declaration, and continues to the limit of time allowed by the law, viz., for a life or lives in being and twenty-one years thereafter.

The chemical laboratory at Brown University has been made about one-third larger during the summer.

Dr. T. H. Montgomery, Jr., assistant professor of zoology at the University of Pennsylvania, has been appointed to the professorship of zoology in the University of Texas, vacant by the removal of Professor W. M. Wheeler to the American Museum of Natural History. Dr. Herbert S. Jennings, assistant professor of zoology at the University of Michigan, and now at Naples, has been called to the assistant professorship of zoology at the University of Pennsylvania.

Dr. E. R. Cummings, Ph.D. (Yale), has been promoted to the position of acting head of the Department of Geology at Indiana University.

Dr. Edward R. Posner has been appointed assistant in physiological chemistry, Columbia University.

Dr. Karl Diener has been appointed associate professor of paleontology in the University of Vienna.

Dr. A. Hansgirg, professor of botany at Prague, has retired after forty years of service.